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This compilation of authoritive practices and standards is offered as a means of obtaining guidelines for those involved in planning and construction of permanent campus facilities for community colleges in Massachusetts for full-time day students. Comparative criteria based on these studies are cited in the following areas--room and station utilization, classrooms, offices, laboratories, libraries, physical education, food services, student services, parking, museums, and auditoriums. (HH)

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

XI

# SPACE ALLOCATIONS AND CAPITAL COSTS

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This chapter is concerned with guidelines for administrators, staff and faculties, for architects and others who are involved with planning and constructing permanent campus facilities for the community colleges in Massachusetts. Essentially it brings together practices and standards from a variety of sources which have proved to be sound and authoritative. It should be specifically noted that these are simply guidelines; they are not, nor are they intended to be, specifications. Every individual construction project will present a unique planning problem depending on the nature of the college, its program and its staff. Similarly the architect will have his own professional skills to apply to the solution of the architectural problem. Thus to consider the data herein as specifications would be too restrictive; they are intended to be guidelines only.

It is safe to say that no building is perfect either for the use originally intended or for other unanticipated and unplanned uses to which it may ultimately be put. Because we see the future but dimly and plan with inevitable error, two protections must be built into any construction plan: flexibility and expansion. No building should be so inflexibly planned that it cannot be accomodated or renovated to another use. Every plant should be so designed that it can be expanded without prohibitive cost even though the nature and requirements of expansion cannot presently be anticipated.

Finally, these guidelines apply to a full-time day college. Only in

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remote circumstances would it be valid to modify plans and projections to accommodate other purposes, such as evening or part-time instruction or community use. For the most part these uses, although legitimate, can be taken care of in a plant which has been adequately planned for day occupancy.

I

Basic to any planning are the assumptions regarding room utilization and occupancy rates. To plan without these assumptions can result in under- or over-building. To build too large for the projected enrollment would be a waste of facilities and public money; to build too small would handicap the college program for the life of the plant.

There are three variables in formulating the assumed utilization rates: the length of the school week, the rate of <u>room</u> utilization, and the rate of <u>student-station</u> utilization. The usual standard school week on which the other variables are based is 45 hours (9 hours a day, five days). This usually assumes a school day with classes beginning at 8:00 A. M. and ending at 5:00 P. M. with classes scheduled through the lunch hour. As the utilization rate for rooms or student-stations approaches the practical maximum, it is easy to provide 11 per cent more facilities by adding an instructional hour beginning at 7:00 A. M. or 5:00 P. M.; if both of these alternatives are used, the available facilities can be increased 22 per cent without cost except for instructional time.

Room utilization is expressed as the average number of hours (or the percentage of the school week) the room is used per week. Student-station utilization is calculated as the average number of hours per week per station

(or as the percentage of student-station-hours used relative to the total available per week. Another, less frequent figure is "student-station-use during periods of room occupance". Since it is impossible to have every room occupied at full capacity for every hour it is in use, it is obvious that student-station utilization must always be less than room utilization. Also, it is virtually impossible because of scheduling problems to use a room for each of the 45 hours a week it is available; thus the room utilization rate is always less than 100 per cent. It is usually assumed that rates in excess of 60 per cent represent somewhat serious scheduling problems and that rates in excess of 80 per cent are evidence of overcrowded conditions sufficiently severe as to contribute to the deterioration of the quality of instruction. As a rule, room-use rates for general classrooms will be significantly higher than for specialized instructional facilities simply because classrooms are general and can be used for instruction in many different fields. Specialized facilities such as laboratories and shops, on the other hand, have only limited uses. Generally also, the more highly specialized the facility the lower its utilization rate. Contrarily, it is generally expected that student-station utilization rates will be higher for specialized facilities than when they are in use for general classrooms.

A number of years ago (1960) James I. Doi and Keith L. Scott conducted a study for the American Association of Collegiate Registrars and Admissions Officers which established normative data that are still definitive in enabling an institution to compare its utilization efficiency with others. See Tables XI-I and XI-2.

TABLE XI-I

PERCENTILE NORMS FOR ROOM UTILIZATION
AVERAGE NUMBER OF PERIODS PER WEEK PER ROOM

| Percentile Rank | General Classrooms | | Teaching Laboratories | |
|---|---|---|---|---|
| | For All Institutions N=216 | For Junior Colleges N=26 | For All Institutions N=205 | For Junior Colleges N=25 |
| 99 | 45.0 | 45.0 | 39.0 | 39.0 |
| 90 | 27.3 | 30.9 | 22.4 | 29.4 |
| 80 | 25.0 | 26.4 | 19.0 | 26.0 |
| 70 | 22.8 | 25.1 | 16.7 | 21.3 |
| 60 | 20.5 | 23.5 | 15.4 | 20.0 |
| 50 | 19.1 | 22.9 | 14.1 | 18.7 |
| 40 | 18.0 | 19.1 | 12.3 | 16.7 |
| 30 | 16.9 | 16.0 | 11.1 | 15.1 |
| 20 | 15.8 | 14.3 | 10.0 | 14.0 |
| 10 | 13.5 | 12.0 | 8.3 | 11.1 |
| 1 | 9.3 | 10.6 | 3.0 | 9.8 |

TABLE XI-2

PERCENTILE NORMS FOR STUDENT HOURS PER WEEK PER STATION
AVERAGE NUMBER OF STUDENT HOURS PER WEEK PER STATION

| Percentile Rank | General Classrooms | | Teaching Laboratories | |
|---|---|---|---|---|
| | For All Institutions N=197 | For Junior Colleges N=23 | For All Institutions N=186 | For Junior Colleges N=22 |
| 99 | 42.7 | 42.7 | 35.1 | 24.8 |
| 90 | 18.9 | 25.8 | 16.3 | 22.0 |
| 80 | 15.5 | 19.1 | 13.7 | 17.2 |
| 70 | 13.0 | 17.3 | 11.6 | 14.8 |
| 60 | 12.0 | 13.5 | 10.6 | 12.7 |
| 50 | 10.8 | 12.6 | 9.1 | 12.5 |
| 40 | 9.9 | 11.7 | 7.8 | 9.7 |
| 30 | 9.0 | 9.6 | 6.9 | 8.6 |
| 20 | 8.1 | 7.8 | 5.6 | 7.4 |
| 10 | 6.5 | 5.7 | 4.3 | 4.5 |
| 1 | 1.0 | 1.0 | 1.6 | 1.6 |

Source: Doi and Scott, Normative Data on the Utilization of Instructional Space in Colleges and Universities, AACRAO, 1960, pp. 4,5.

In planning new facilities, convenient assumptions regarding maximum utilization rates might be:

General Classrooms: 80 per cent at 60 per student-station utilization.

Laboratories: 60 per cent at 80 per cent student-station utilization.

The State University of New York Office of Facilities in its document dated January 9, 1964, listed the following practical utilization guides:

Room Utilization: hours per week, based on 45 hour week

| | |
|---|---|
| Classrooms ---- 60 or less | 30 |
| Classrooms ---- 61 - 120 | 15 |
| Lecture Halls -- 121 and over | 10 |
| Labs and special purpose rooms | 20 |
| Industrial Arts and shops | 25 |

Station Utilization (all rooms, when occupied)

| | |
|---|---|
| Classrooms | 80% |
| Other spaces --- if possible ------ | 100% |

The Guide for Planning Community College Facilities published by the Division of Field Studies and Research of the Graduate School of Education of Rutgers University says:

> Since many community colleges have a thirty-five hour week, 80% utilization is desirable for general purpose areas, 70-75% for shops and laboratories. In community colleges with a large technical program, these percentages might be reversed. (p. 15)

A Restudy of the Needs of California in Higher Education, published in 1955, makes several references to utilization standards:

> The Strayer Committee Report (1948) contains this statement on classroom utilization: . . . an over-all classroom utilization equal to 65 per cent of all the instructional room hours available in a 45 hour week has been established as standard. . . This degree of utilization closely approaches the maximum that any college or university can attain without overcrowding

or extending its school week beyond desirable limits. (p. 308)

The standard of 'room saturation hours per week' (for instructional space) was established in a letter from the State Director of Education to the State Director of Finance under the date of March 21, 1951:. . . calucations will be based upon a usage of 33.7 hours per week for classrooms and 22.5 hours per week for special service rooms and laboratories. This assumes a 45-hour week, 75 per cent utilization for classrooms, and 50 per cent utilization for laboratories. (p. 313)

. . . the Restudy staff has concluded that for the entire week of whatever length the institution wishes to operate its regular program, the following utilization standards are attainable, and it is therefore recommended that:

> The standard room utilization of classrooms be, on the average, 36 scheduled hours per week with class enrollments averaging 67 per cent of room capacity.
>
> The standard room utilization of teaching laboratories be, on the average, 24 scheduled hours per week with class enrollments averaging 80 per cent of room capacity. (p. 321)

Robert Heller Associates, Cleveland, Ohio, who did the University of Massachusetts Boston Campus Facilities and Location study, dated November 24, 1964, listed 80% room use with 60% seat occupancy for classrooms and 60% room use with 80% seat occupancy for laboratories as their standards. (p. 13)

Becker and Becker Associates, New York, who did the Space Utilization Report for the State Teachers Colleges and LTI., in 1960, list desirable rates for classrooms at 26 periods per week (based on a 33 hour week) (79%) and 20 periods for teaching laboratories (61%). (p. 62)

II

In the very first stages of planning facilities it is useful to have

general rules of thumb to estimate gross size and costs.

Recognizing that gross square footage per student will vary widely on the basis of the instructional program planned, a common estimate is 130-150 gross square feet per student, including approxomately 30 per cent for walls, corridors, lobbies, utilities and mechanical spaces and "public space". Thus, a campus planned for 1,500 students would contain approximately 195,000-225,000 square feet.

There is a simple formula for projecting the number of teaching stations needed. It will project only the minimum number based on the estimated total enrollment of the college at full operation. The formula is:

$$\frac{\text{Number of full-time equivalent students}}{\text{Average class size}} \times \frac{\text{Average hours per week students are in class}}{\text{Average hours per week rooms in use (utilization factor)}} = \text{Number of teaching stations needed.}$$

Obviously this formula takes no account of specialized instructional facilities, such as laboratories, which an institution must have regardless of size; therefore the teaching station figure yeilded by the formula is minimum and must be adjusted upward to accommodate the projected program of the college. If applied on a course-by-course basis for each curriculum the college intends to offer, a more practical solution will be reached which will incorporate needed specialized or limited purpose teaching stations with multi-purpose stations such as general classrooms.

Five years ago, $4,000-$4,500 per student was a generally accepted capital cost figure per student including both construction and equipment; but in the last five years both construction and equipment costs have

increased at roughly five per cent a year. Translating this into 1966 dollars, these base estimates would now approximate $5,100-$5,750 per student. This estimate is very general since it is well-recognized that construction costs and rates of inflation vary widely in different sections of the country. Tentatively, then, without taking account of the many variables in estimating costs, it would be expected that a campus for 1,500 students would cost between $7,650,000 and $8,625,000.

Based on an assumption of 135 gross square feet per student, the hypothetical figures would represent an overall gross square foot cost per student of $37.77-$40.57. If it were to be assumed that about one third of capital costs would be in equipment, it would follow that gross construction costs, including site acquisition and site development, architects' fees, and other incidental costs and contingencies in addition to the contract building costs, would be between $25.18 and $27.04 per gross square foot. Table XI-3 reveals the total hypothetical cost to the Commonwealth, in 1966 dollars, for the thirteen established and recommended community colleges for which total capital appropriations have not yet been made. These estimates are based on projected enrollments for 1975. On the basis of these figures it would appear that for each of the eight remaining fiscal periods between the present and 1975 (FY 68-75) an average appropriation of between 29.1 and 32.9 millions would be required to bring the community college system into full operation.

Although this chapter is concerned with capital costs, it would be worthwhile to look briefly at total operating costs by 1975. On the assumption that $900 is a reasonable cost per student in 1966 and that the

projected enrollment of 53,000 is reached by 1975, the total annual operating costs for the community college system would reach $47.7 millions by that date (in 1966 dollars). If it is further assumed that the present tuition ($200) remains unchanged, the net annual operating cost to the Commonwealth would be $37.1 millions. Also, it should be remembered that if the instructional programs of the colleges are heavily weighted on the side of occupational education, as it is expected, the annual operating costs could be significantly higher.

TABLE XI-3

HYPOTHETICAL SIZE AND COSTS FOR COMMUNITY COLLEGES FOR WHICH TOTAL CAPITAL APPROPRIATIONS HAVE NOT BEEN MADE

1966 Dollars

| | Enrollment | Gross Square Feet at 135 Square Feet per student | Total Costs At $5,100 per student | Total Costs At $5,750 per student |
|---|---|---|---|---|
| Massachusetts Bay | 5,000 | 675,000 | $ 25,500,000 | $ 28,750,000 |
| Greenfield | 1,200 | 162,000 | 6,120,000 | 6,900,000 |
| Quinsigamond | 5,000 | 675,000 | 25,500,000 | 28,750,000 |
| Holyoke | 5,000 | 675,000 | 25,500,000 | 28,750,000 |
| Mt. Wachusett | 2,000 | 270,000 | 10,200,000 | 11,500,000 |
| North Shore | 5,000 | 675,000 | 25,500,000 | 28,750,000 |
| South Shore | 3,000 | 405,000 | 15,300,000 | 17,250,000 |
| Bristol | 3,500 | 337,500 | 12,750,000 | 14,375,000 |
| West Suburban | 4,500 | 607,500 | 22,950,000 | 25,875,000 |
| Northwest Suburban | 4,500 | 607,500 | 22,950,000 | 25,875,000 |
| Southwest Suburban | 3,000 | 405,000 | 15,300,000 | 17,250,000 |
| Southwest Boston | 2,000 | 270,000 | 10,200,000 | 11,500,000 |
| Massasoit | 3,000 | 405,000 | 15,300,000 | 17,250,000 |
| | 45,700 | 6,169,500 | $233,070,000 | $262,775,000 |

# III

In the pages that follow, planning standards and criteria have been brought together from a number of reputable sources to guide campus planners and architects. The earlier admonition in the first paragraph of this chapter should be recalled: that every separate construction project will present a unique planning problem depending on the nature of the college, its program and its staff. Therefore the standards contained herein are to be considered as norms and guides, not as specifications. The various authorities referred to are footnoted at the end of the chapter.

## General Classrooms

Becker and Becker refer to two basic classroom sizes: 24' x 24' (576 square feet) for 28 student-stations and 24' x 24' (672 square feet) for 35 student-stations. This is based on a 144 square foot unit for the teaching station plus approximately 15 square feet per student-station with tablet-arm seating. These sizes in multiples also provide for lecture-demonstration rooms up to 80 student-stations and for 24 station seminar and conference rooms.

Florida standards provide for an average general classroom size of 650 square feet.

New York ('64) sets the following standards for general classrooms:

20 stations: 18 square feet per student - 360 square feet
30 stations: 16 square feet per student - 480 square feet
60 stations: 16 square feet per student - 960 square feet

New York ('62) allowed 22 square feet per station for seminar rooms.

Rutgers standards are 15 square feet per student in tablet arm seating

plus 175 square feet for the teaching station. For chair-desk or tables-and-chairs seating the standards are 25 square feet per student plus 175 square feet for the teaching station.

Heller Associates calculate on the basis of 25 square feet per student-station, while the University of Massachusetts uses 17.5 square feet.

Kenneth Skaggs, a well-known community college planning authority now with the staff of the American Association of Junior Colleges, uses the following criteria:

25-40 student stations - 700 square feet
40-60 student stations - 1050 square feet
80-100 student stations - 1500 square feet
200-500 student stations - 3850 square feet

One of the most thorough and detailed studies was prepared in April, 1964, by the Association of State Institutions of Higher Education in Colorado in co-operation with Taylor, Lieberfeld and Heldman, Inc., of New York City, entitled Guideline Procedures for Campus Development and Capital Outlay Planning. Recommendations of this study regarding general classrooms are shown in Table XI-4 and Table XI-5.

For larger lecture-demonstration rooms the standards change somewhat. Becker and Becker recommend an allowance of 16 square feet per station in rooms seating 100-150 students; Heller Associates, 10 square feet per station and the University of Massachusetts also plans on 10 square feet. New York ('64) standards are:

120 stations: 12 square feet per student - 1440 square feet
240 stations: 12 square feet per student - 2880 square feet
480 stations: 10 square feet per student - 2800 square feet

## Laboratories and Special Purpose Instructional Areas

The best analysis of these areas is provided by the Colorado study and adapted in Table XI-6. For all types of science laboratories other standards are fairly consistent: New York ('62) recommended an allowance of 40 square feet per student-station in general laboratories with "island" bench installations. New York ('64): 24 station labs, 50 square feet per station plus 420 square feet for storage and preparation; Rutgers, 50 square feet per station; Heller Associates and the University of Massachusetts both use 48 square feet per student.

For biology, Becker and Becker recommend the following standards: 1056 square feet for sections of 32 students (33 square feet per student-station) plus 144 each for storage and preparation, and for advanced courses 1344 square feet for sections of 32 students (42 square feet per student-station) plus 96 each for refrigeration and "sterile-incubation" and 196 each for storage, preparation, animal room and "plant growing".

Becker and Becker recommend the same standards as biology for elementary chemistry courses and for advanced chemistry courses the same sized laboratory but with 196 square feet each for storage and preparation and 288 square feet for a balance room. New York ('62) allowed 35 square feet per student-station for chemistry and physics.

Beckers' recommendations for physics and physical science laboratories are 1200 square feet for elementary courses (37.5 square feet per station) plus 144 each for storage and preparation; advanced courses will require 1344 square feet at 42 feet per station plus 196 each for storage and preparation, 168 each for optics and a dark room and 288 square feet for special test equipment.

New York ('62) allowed 40 square feet per student-station in vocational shops with equipment and 75 for general shops with equipment. New York ('64) recommends 24 station industrial labs at 50 square feet per station plus 180 feet of storage, whereas Rutgers recommends 150 square feet per station for various laboratories of this type.

Other Becker and Becker standards are :

| | |
|---|---|
| Earth science lab: | 36 stations at 32 square feet per station. |
| Music rooms: | 32 student-stations at 21 square feet per station. |
| Arts, crafts and fine arts: | 32 stations at 42 square feet per station. |

In fine arts New York ('64) State recommends 30 station rooms at 40 square feet per station plus 240 feet for storage; Rutgers suggests simply 50 square feet per student-station.

For language and speech laboratories New York ('64) recommends 24 station rooms at 30 square feet per station, including console and storage and Rutgers is consistent at 50 square feet per student-station. It should be noted that language laboratories are usually built for not less than 30 student-stations and frequently for more.

Rutgers includes standards for two other types of specialized instructional space:

| | | |
|---|---|---|
| Business labs: | typewriting and office machines: | 30 square feet per station |
| | Office practice: | 50 square feet per station |
| Dental, medical | assisting and nursing labs: | 50 square feet per station |

TABLE XI-4

Recommended Planning Criteria for the Allocation of Space to Classroom-Type Facilities[1]

| Space Category and Room Capacity | | Unit Area per Station (square feet) | Total Area[2] |
|---|---|---|---|
| Regular classrooms | | | |
| Capacity: | 20 stations | 17.6 | 352 |
| | 30 stations | 14.4 | 432 |
| | 40 stations | 13.0 | 520 |
| | 50 stations | 12.1 | 605 |
| | 60 stations | 11.5 | 690 |
| | 75 stations | 10.9 | 818 |
| | 100 stations | 12.7 | 1270 |
| | 125 stations | 11.9 | 1488 |
| | 150 stations | 11.3 | 1695 |
| | 175 stations | 10.9 | 1908 |
| | 200 stations | 10.6 | 2120 |
| Seminar-conference rooms | | | |
| Capacity: | 10 stations | 20.0 | 200 |
| | 20 stations | 20.0 | 400 |
| | 30 stations | 18.0 | 540 |
| Lecture-auditoriums | | | |
| Capacity: | 500 stations | 9.2 | 4600 |
| | 1000 stations | 8.6 | 8600 |
| | 1500 stations | 8.2 | 12300 |

1. Source: Guideline Procedures and Criteria for Campus Development and Capital Outlay Planning, prepared by the Association of State Institutions of Higher Education in Colorado in cooperation with Taylor, Lieberfeld and Heldman, Inc., New York, N.Y., April, 1964, p.111

2. These are general classroom facilities. The unit allocation criteria permit inclusion of projection facilities, demonstration benches for science lectures, other special equipment in addition to the actual seating stations.

TABLE XI-5

Alternate Basis for Allocation of Space to Classroom-Type Facilities[1]

| Space Category and Room Capacity | Unit Area per station (square feet) | Allocation to Circulation in Room | Total Area Required for Room |
|---|---|---|---|
| **Type 1: Tablet armchairs, 2 longitudinal aisles, no rear aisle** | | | |
| 16 - 25 | 8 | 190 | 320 - 390 |
| 26 - 35 | 8 | 195 | 390 - 475 |
| 36 - 45 | 8 | 200 | 475 - 560 |
| 46 - 55 | 8 | 205 | 560 - 645 |
| 56 - 70 | 8 | 210 | 645 - 770 |
| 71 - 90 | 8 | 220 | 770 - 940 |
| **Type 2: Tablet armchairs, 3 longitudinal aisles, 1 rear aisle** | | | |
| 91 - 125 | 8 | 470 | 1200 - 1470 |
| 126 - 175 | 8 | 495 | 1470 - 1895 |
| 176 - 225 | 8 | 520 | 1895 - 2320 |
| **Type 3: Rows of tables and chairs, 2 longitudinal aisles** | | | |
| 16 - 25 | 12 | 250 | 440 - 550 |
| 26 - 35 | 12 | 260 | 550 - 680 |
| 36 - 45 | 12 | 270 | 680 - 810 |
| 46 - 55 | 12 | 280 | 810 - 940 |
| **Type 4: Lecture-auditoriums** | | | |
| 176 - 225 | 8 | 520 | 1895 - 2320 |
| 226 - 375 | 8 | 530 | 2320 - 3530 |
| 376 - 500 | 8 | 600 | 3530 - 4600 |
| 501 - 1000 | 8 | 600 | 4600 - 8600 |
| 1001 - 1500 | 7.8 | 600 | 8600 - 12300 |
| **Type 5: Seminar-conference rooms** | | | |
| -- - 10 | 20 | (included in station area) | --- - 200 |
| 11 - 20 | 20 | | 200 - 400 |
| 21 - 30 | 18 | | 400 - 540 |

1. Source: Guideline Procedures and Criteria for Campus Development and Capital Outlay Planning, prepared by the Association of State Institutions of Higher Education in Colorado in cooperation with Taylor, Lieberfeld and Heldman, Inc., New York, N.Y., April, 1964, pp.112-113.

TABLE XI-6

Recommended Planning Criteria for the Allocation of Space to Special Purpose Instructional Areas[1]

| Subject | Unit Area per Student-Station (square feet) | Service Space as Per Cent of Primary Inst'l Space[2] |
|---|---|---|
| **Biological Sciences** | | |
| Biological Sciences | 35 | 32 |
| Biology, General | 35 | 39 |
| Botany | 35 | 27 |
| Zoology | 35 | 16 |
| Anatomy & Histology | 35 | 25 |
| Bacteriology | 45 | 47 |
| Biochemistry | 50 | 32 |
| Biophysics | 45 | 32 |
| Entomology | 35 | 32 |
| Genetics | 35 | 32 |
| Physiology | 45 | 32 |
| Microbiology | 45 | 32 |
| **Mathematical Sciences** | | |
| Computer Science | 20[3] | 23 |
| **Physical Sciences** | | |
| Physical Science, General | 35 | 32 |
| Chemistry, Gen'l & Elementary | 40 | 32 |
| Quantitative, Qualitative & Organic | 45 | 32 |
| Geology | 40 | 30 |
| Physics | 40 | 35 |
| **Engineering Sciences** | | |
| Civil Technology: hydraulics, concrete | 75-100 | 22 |
| strength of materials | 150 | 22 |
| photogrammetry | 50 | 22 |
| Electrical Technology: circuits | 75 | 22 |
| machines, power | 125 | 22 |
| measurements, control systems | 45 | 22 |
| Electronic Technology | 45 | 22 |
| Mechanical Technology: mechanical, mfg. processes | 200 | 22 |
| thermodynamics | 200 | 22 |
| machine shop, machines | 50 | 22 |
| Metallurgical Technology | 40 | 22 |
| Industrial Technology | 65 | 22 |

Table XI-6 (con'td)

| | | |
|---|---|---|
| Social Sciences, (Lab-oriented) | | |
| Anthropology-Archaeology | 35 | 22 |
| Geography | 35 | 18 |
| Psychology: General | 40 | 23 |
| Learning, perception | 45 | 23 |
| Testing | 75 | 23 |
| Observation booth station | 12 | — |
| Library Science & Bibliography | 50 | 22 |
| Arts and Crafts | | |
| Architecture: design, projection, drawing, rendering | 35 | 43 |
| Fine Arts: drawing, painting | 35 | 22 |
| advanced painting | 45 | 22 |
| sculpture, ceramics, pottery, crafts | 50 | 22 |
| Commercial Art | 35 | 23 |
| Industrial Arts & Crafts: woodworking, machine shop | 50 | 25 |
| welding, sheetmetal | 80 | 25 |
| Music | (4) | 41 |
| Engineering Drawing, Graphics | 35 | 27 |
| Language and Literature | | |
| Language Laboratories | (5) | 20 |
| Speech and Drama | (6) | 49 |
| Business | | |
| Accounting | 25 | — |
| Typewriting, secretarial | 25 | 14 |
| Home Economics | | |
| General | 40 | 37 |
| Clothing and Textiles | 25 | 20 |
| Food and Nutrition | 40 | 33 |

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1. Source: Adapted from Colorado study, op. cit. p. 135 et. seq.

2. This is a net addition to the primary space. Included are preparation rooms, projection booths, stages, dressing rooms, storage facilities, etc.

3. In seminar-classroom. Actual machine area will depend upon size of installation. A typical teaching-oriented installation, excluding office and instructional area, would require 800 feet.

4. Individual practice rooms require 80 square feet; allow 15 square feet per participant for large group practice rooms such as choral, band, or orchestral groups.

5. Booth requires 25 square feet. Recording room requires 75 square feet. Control station with console included in station criteria.

6. Basic stage and pit set-up varies in size with character of theater; i.e., both size and style. A basic proscenium type stage set-up can be accommodated in 2700 square feet. About 300 square feet are required for an orchestra pit. A practice studio stage need not be more than 200 square feet. The service space coefficient applies to total space, excluding seating and lobby area.

## Offices and Administrative Space

Presidents: Becker and Becker: 432 square feet, including private toilet.
New York ('64): 400 square feet.
Colorado: 300 square feet.

Vice President or Principal Deans:
Becker and Becker: Academic Deans, Deans of Men and Women: 168 square feet.
New York ('64): 300 square feet.
Colorado: 300 square feet.
University of Massachusetts: 250 square feet.

Subordinate Deans and Directors or equivalent:
Becker and Becker: Assistant Deans: 140 square feet.
New York ('64): Deans and directors: 240 square feet.
Associate Deans or equivalent: 180 square feet.

Other administrative officers:
Becker and Becker: Registrar: 168 square feet.
Guidance and Placement Officers: 280 square feet.
New York ('64): "Other" administrative officers: 120 square feet.
Heller Associates: "Managers": 200 square feet.
"Senior Personnel:" 125 square feet.
Colorado: Director, major administrative department: 200 square feet.
Director, small administrative department: 120 square feet.

Clerical support offices:
Becker and Becker: Accountant or Head Bookkeeper: 120 square feet.
Secretary: 112 square feet.
Bookkeeper or Office Manager: 100 square feet.
Typist-Stenographer: 48 square feet.
Clerk: 42 square feet.
Heller Associates: Clerical offices: 100 square feet per office.
Colorado: Private Secretary: 120 square feet.
Bookkeepers and Office Manager: 80-90 square feet per person.
Typist-Stenographer: 60-65 square feet per person.
University of Massachusetts: Clerical Offices: 80 square feet.

New York ('64): Private Secretary or 2 secretaries: 120 square feet each.
Three or more secretaries in same area: 80 square feet each.

Miscellaneous administrative spaces:
Becker and Becker: Switchboard office: 36 square feet.
Admissions counter: 192 square feet.
Admissions-reception areas: 10 square feet per person seated.
Duplicating room: 96 square feet per file.
Filing area: 7.8 square feet per file.
Office supply storage: 96 square feet.
Vault: 84 square feet.

Academic Offices:
Division Chairmen: New York ('64): 240 square feet.
Department Chairmen: Becker and Becker: 168 square feet.
New York ('64): 180 square feet.
Colorado: 200 square feet.
University of Massachusetts: 200 square feet.
Faculty Offices: Becker and Becker: 140 square feet, double occupancy.
New York ('64): 240 square feet, double occupancy.
Heller Associates: 125 square feet, 1.6 faculty per office.
Colorado: multi-occupancy: 80-90 square feet per occupant.
Skaggs: 75 square feet.
University of Massachusetts: 125 square feet per FTE faculty.

## Libraries

One of the most difficult instructional areas to plan, yet the most important, is the library. The difficulty is twofold: standards and practices vary widely and the space needed depends significantly on concepts of the role of the library in the college program. At least five important trends can be identified at this time, all involving changing philosophies of the library and its function in the environment of the college. Each one,

naturally, has implications for planning and space allocation standards.

1. Seating for a larger proportion of the student body.
2. Carrels and individual study areas in preference to "gang" seating at tables.
3. Higher minimum standards for the size of the book collection.
4. A broadening concept of the traditional role of the library in the direction of an instructional- or learning-materials center, which involves,
5. Increasing emphasis upon non-book collections.

The American Library Association has promulgated "guidelines" for the size of the book collection which have been reluctantly acknowledged by most college administrators and accepted as "standards" by many accrediting agencies including the regional associations. These guidelines call for a minimum collection of 20,000 volumes for the first 1,000 of enrollment, exclusive of duplicates and texts, plus 5,000 volumes for each additional 500 students.

Seating standards range from a low of 20 per cent of the full-time equivalent student body to a high of 33 per cent. There are two arguments affecting this decision. One side argues for the higher of these standards for community colleges on the grounds that the commuting student does not have an on-campus dormitory room to which he can retire for study between classes and in the evening and that therefore an on-campus place must be provided for him, thus, raising the proportion of the total student body to be seated in the library at a particular moment of time. The other side argues that because the community college student is a commuter, he has

home and other off-campus study facilities accessible to him, including local public libraries and that, therefore, the community college does not need to provide as much on-campus study space for him as would a residential college. Without regard to which of these positions is correct, the current seating standard is stabilizing at a minimum of 25 per cent with a higher capacity desirable. Skaggs makes the point: ". . . plan to seat 25 per cent of the total day enrollment; more generous and allowing for expansion would be 30 per cent". Florida standards provide for seating one-third of the full-time equivalent enrollment in colleges of less than 1,000 and for 25 per cent for FTE enrollment over 1,000. Kansas and New York State ('64) provide for 20 per cent, while Rutgers, Colorado (see Table XI-7), and the California Restudy require a 25 per cent minimum.

Space required per study-station:

| | |
|---|---|
| 20 square feet: | New York ('64) (This is reduced from 25 in '62). |
| 25 square feet: | Florida<br>Skaggs |
| 30 square feet: | Engelhardt<br>California (includes "circulation and staff offices)<br>Heller Associates<br>University of Massachusetts |

Book storage standards are somewhat more precise than seating standards. They are stated as volumes per square foot or as square feet per volume, either of which is easily converted into the other:

| Square feet per volume | | Volumes per square foot | | |
|---|---|---|---|---|
| Heller Associates | .10 | Florida | 16 | |
| University of Mass. | .10 | New York ('64) | 15 | |
| Colorado (See Table XI-7) | .10 | Rutgers | 15 | (2vol. per cubic foot) |
| | | Skaggs | 12 | |
| | | Engelhardt | 10 | |
| | | California | 10 | (up to 150,000 vols.) |

Additional standards for book storage may be useful. It is usual to allow 6 or 7 volumes per linear foot of shelving and 125 or 126 volumes per standard 3' section of stacks, 76" high.

Rutgers standards allow one station in a library typewriting room for each 50 study-stations and 35 square feet per station in typewriting and conference rooms. California allows 350 square feet for a conference room; New York ('64) provides 25 square feet per station in conference rooms.

New York ('64) standards for library service areas allow 100 square feet per person for order and cataloging rooms and 75 square feet per person in other kinds of work- and service-rooms.

Table XI-7 shows Colorado library standards in some detail.

## Physical Education

Gymnasiums, swimming pools and other physical education space is frequently accorded a low priority in a construction program. Laymen and legislators often think that such capital expenditures are for inter-collegiate competition only and are sometimes reluctant to appropriate public money for this "frill". It should be pointed out that in the large majority of higher education institutions, including community colleges, at least two years of physical education are required in the curriculum.

The accepted view is that physical education is properly a part of a curriculum to serve the educational needs of a "well-rounded" person. An analogy is the role of general education in a technical curriculum. Technical competence does not require general education, but the neglect of general education in a technical curriculum produces an incomplete adult. Similarly, the neglect of the health and physical education aspect is to provide an unbalanced, incomplete curriculum. A health and physical education program

designed to provide those interests, skills and knowledges which the student will employ in his adult life is an essential part of the total community college curriculum. It is especially important in community colleges from which a significant number of graduates transfer to senior colleges, since physical education is usually required in the first two years of the four-year curriculum. If it is not provided in the community college curriculum, the transfer student is at a disadvantage or "out of phase" in the upper division.

The point often overlooked is that if physical education is to be offered in the community college curriculum, it requires specialized instructional facilities exactly as do the laboratory sciences, technical curriculums, music, art or typewriting. The use of physical education facilities for competitive or inter-collegiate athletics is secondary and incidental to thier use as instructional facilities.

In milder climates such as Florida and California, it might be argued that indoor physical education facilities are not quite so urgent since an outdoor program can be carried on for all or a large portion of the academic year. New England climate, on the other hand, requires indoor facilities. In either case, locker, dressing and showering rooms must be provided indoors.

The Rutgers standards allow 110 square feet per student-station for physical education. New York ('64) provides a gymnasium of approximately 106' x 120' or 12,720 square feet. Full length lockers, 12" x 12" each require 6 square feet; if a tote basket scheme is used, 0.6 square feet should be allowed per basket.

Table XI-8 shows Colorado standards for indoor physical education space and Table XI-9 shows land requirements for the outdoor program.

TABLE XI-7

Recommended Planning Criteria for the Allocation of Space to Selected Components of Library Facilities[1]

| Space Category | Assignable Square Feet | Per Cent |
|---|---|---|
| Reader station space: | | |
| Reader stations as per cent of enrollment | -- | 25 |
| Unit area allocation per reader station: | | |
| General reading rooms[2] | 18 | |
| Special reading rooms[3] | 22 | |
| Carrels | 30 | |
| Faculty study stations | 48 | |
| Book storage space: | | |
| Unit area per volume: | | |
| Closed stacks | .080 | |
| Open stacks | .100 | |
| Open shelving in reading rooms | .133 | |
| Service space: | | |
| As per cent of total library space: | | |
| Large libraries[4] | | 17 |
| Small libraries[5] | | 20 |
| As per cent of reader and book storage space: | | |
| Large libraries[4] | | 20 |
| Small libraries[5] | | 25 |

1. Source: Adapted from Colorado Study, op. cit., pp.234-5.

2. For rooms with 60 or more stations.

3. Periodicals, reference, etc.; reading rooms with 40 stations or less.

4. Total library space of 40,000 square feet.

5. Total library sqace of less than 40,000 square feet.

TABLE XI-8

Recommended Planning Criteria for Selected Component of Indoor Physical Education Facilities[1]

| Activity Station or Component | Assignable Square Feet |
|---|---|
| Basketball courts: | |
| Practice court | 4370 |
| Competition court | 6240 |
| Combination, 2 practice courts and 1 competition court | 8735 |
| Handball, 4-wall | 1060 |
| 1-wall | 680 |
| Squash, doubles | 1125 |
| singles | 595 |
| Shuffleboard | 625 |
| Volleyball, per court | 3025 |
| Wrestling, per mat | 1155 |
| Boxing: | |
| Ring | 900 |
| Punching bag, per bag | 15 |
| Heavy bag, per bag | 35 |
| Pool, Olympic standards, six lanes | 7130 |
| Exercise room, per person | 50 |
| Rifle range, per firing position | 400 |
| Pistol range, per firing position | 320 |
| Fencing, per strip | 325 |
| Spectator seating, foldable, per seat | 2.5 |
| Lockers, per locker | |
| Varsity rooms | 10 |
| General locker rooms | 6.75 |
| Tote basket | .50 |
| Showers, per head, gang showers | 16 |
| Shower-dressing staff for women, per unit | 24 |
| Ticket booth | 25 |
| First aid, training, physical therapy room | 750 |

1. Source: Colorado Study, op. cit., p.262.

2. With the exception of self-contained facilities (handball, squash, etc.) the criteria all include allowances for buffer zones or circulation space around actual playing or conpetition areas.

TABLE XI-9

Recommended Planning Criteria for Land Allocation
for Selected Physical Education Uses[1]

| Item | Planning Criterion |
|---|---|
| Swimming pool | .16 acres per unit |
| Track | 4.00 acres per unit |
| Baseball field | 2.50 acres per unit |
| Softball field | .92 acres per field |
| Football field (touch) | 1.6 acres per field |
| Soccer field | 1.86 acres per field |
| Archery | .07 acres per line |
| Hockey rink | .49 acres per rink |
| Volleyball court | .07 acres per court |
| Basketball court | .18 acres per court |
| Tennis court | .17 acres per court |
| Stadium: | |
| Football field | 1.74 acres |
| Spectator seating | 4 square feet per seat |

1. Source: Colorado Study, op. cit., p.385.

Note: Proper attention should be given to the orientation of playing fields relative to the sun.

## Student Services, Lounges, Recreation

The individuality of the college and its views as to its responsibility to assign space for student services including lounges, commons, recreation and informal study areas make difficult the development of guidelines under this heading. A few suggestions:

Heller Associates: 20 square feet per student-station.
Colorado: Facilities located in the student center, per student: 8.25 square feet.
Facilities located outside the student center, per student: 1.50 square feet.
Total, all facilities: 9.75 square feet
Lockers, per full-size, floor standing locker: 6.75 square feet.
Lounges, commons rooms, per station: 20 square feet.
New York ('62): Recreation rooms: 50 square feet per station.

The Colorado study makes the following notation:

> The planning criterion of 9.75 square feet per student would apply only in the absence of student center facilities. Should student center facilities be provided separately, the service areas outside the student center could be scaled down to about 1.5 square feet per student. The planning criterion for the allocation of space per student in student center facilities may vary widely since it is largely dependent upon the character and extent of the individual space or activity components that are included.

## Food Services

Similarly, the diversity of services to be provided makes difficult the projection of guidelines for this item. Also, it is more or less an area of service in which the educator is easily available. Florida, New York and Colorado include some useful planning criteria:

Florida: Cafeteria: 15 square feet per student served.
"Kitchen areas": 1.5 square feet per meal served up to 500.
1.0 square feet per meal above 500.
New York ('64): Seating for not more than 35 per cent of the total enrollment.
12 square feet per student served.

Kitchen (preparation): 3.6-5.6 square feet per diner.
Dishwashing, refrigeration, storage: 4.0-5.3 square feet per diner.

Colorado: See Table XI-10.

TABLE XI-10

Recommended Planning Criteria for the Allocation of Space to Food Service Facilities[1]

| Item | Planning Criteria: Assignable Square Feet — Number | Per Cent | Other |
|---|---|---|---|
| Cafeteria: | | | |
| Number of sittings at peak interval[2] | | | 4 |
| Utilization rate[3] | | | 80% |
| Aggregate food service space requirements per dining station | 24.5 | 100 | |
| Dining area | 11.0 | 45 | |
| Preparation, serving, cleanup | 7.5 | 31 | |
| Storage & miscellaneous | 6.0 | 24 | |
| Snack bar: | | | |
| Number of sittings at peak interval[2] | | | 6 |
| Utilization rate[3] | | | 80% |
| Aggregate food service space requirements per dining station | 20.5 | 100 | |
| Dining area | 10.0 | 49 | |
| Preparation, serving, cleanup | 5.5 | 27 | |
| Storage & miscellaneous | 5.0 | 24 | |

1. Source: Colorado study, op.cit., pp.300-1.

2. Turnover factor

3. Proportion of dining stations occupied at any one time during peak interval.

## Parking

The amount of acreage to be allocated to parking is always a matter of great controversy. Naturally, an important planning factor is the accessibility and availability of public transportation, but as has been pointed out earlier in this report, public transportation does not <u>really</u> affect planning too much since people, particularly students, seem to favor private vehicles even if public transportation is readily available.

Another interesting point is that even with adequate total parking facilities, the same confusion, concentration and parking violations will occur at points of first contact with campus buildings as if facilities were not adequate. People seem to prefer parking as near as possible to the building they will enter even at the risk of parking violations than to park within the regulations but a step further away. For this reason, it is probably better to plan several smaller lots giving convenient access to specific buildings or clusters of buildings rather than a single large lot.

Various standards provide not less than .50 parking space per student. Florida standards specify 1 space per student at time of peak attendance. Probably a realistic guideline is .75 spaces per student at time of maximum attendance, usually 10:00 A. M. or 11:00 A. M.

New York ('62) standards calculate acreage needed at 145 cars per acre; Colorado specifies 180 compact and 132 standard vehicles per acre.

## Miscellaneous

<u>Museum and gallery space</u>: This planning criterion will depend upon the nature and size of the student body, the character of the curriculum and the "mix" of the collections. Unless there are special collections of considerable significance or an important community service planned,

lobbies and wide corridors are probably adequate display and gallery space. Planning for this kind of space should not exceed 1.80 square feet per student and if it is included in planning a ratio between display space and storage and service space should be remembered: display, 1.5 square feet, service, .14 and storage, .16.

Auditoriums and theaters: These areas, if they are to be included in the campus facilities are best designed by professional experts, but for preliminary purposes, auditoriums with stages should be calculated at 10 square feet per person and theaters at 7 square feet.

Gross/net and net/gross: The Colorado study provides some useful coefficients for converting gross to net square feet and vice versa:

TABLE XI-11

Conversion Coefficients

| | Gross-to-net | Net-to-gross |
|---|---|---|
| High density: buildings with heavy student traffic, offices, classrooms, smaller labs, etc. | 0.60 | 1.67 |
| Medium density: libraries, large labs, larger interior open spaces. | 0.70 | 1.43 |
| Low density: gymnasiums, large lecture halls, large reading rooms, shops, etc. | 0.80 | 1.25 |

Lead time: It is not realistic in the case of a major building project to count on less than 48 months from the initial planning to actual occupancy. This assumes that lead time is carefully adjusted to budget deadlines and to legislative appropriations; otherwise, or if an appropriation fails of legislative approval, the schedule is deferred at least one full

year. Approximately 14 months should be allowed between the time educational specifications are turned over to the architect and the approval of preliminary plans. Six months should be planned after the approval of preliminary plans for the completion of architectural working drawings and 20 months between bidding and occupancy. Detail of equipment and furniture requirements should precede the planned occupancy date by about 18 months.

## Footnotes

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